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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/892,586	06/27/2001	Paul Turner	1086.2002-001	2279

21005 7590 09/06/2007
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EXAMINER	
SHARON, AYAL I	

ART UNIT	PAPER NUMBER
2123	

MAIL DATE	DELIVERY MODE
09/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/892,586	TURNER ET AL.	
	Examiner	**Art Unit**	
	Ayal I. Sharon	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-64* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *23-24* is/are allowed.

6)☒ Claim(s) *1-22 and 25-64* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/23/07, 8/13/07*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Introduction

1. Claims 1-64 of U.S. Application 09/892,586, originally filed on 06/27/2001 are currently pending.
2. The application claims benefit of U.S. Provisional Application 60/214,875 filed on 06/29/2000.
3. Applicants have stated that newly submitted claims 31-59 were copied directly from U.S. Patent Application 10/842,157 to Sayyar-Rodsari et al. (See p.29 of the amendment filed 6/11/07).
4. Contrary to Applicants' statement (see p.29 of the amendment filed 6/11/07) that application is not being examined, the IDS filed 7/23/07 includes a copy of the final office action mailed in that application.
5. Applicants have also stated that newly added claims 60-64 are directed to "the same or substantially the same subject matter as independent claims 31, 50, 55, 56, and 64 of the Sayyar-Rodsari patent application." (See p.29 of the amendment filed 6/11/2007).
6. Examiner has rejected all claims with the Piché reference. The Piché reference was just submitted by the Applicants as reference AV2 in the IDS filed 7/23/07.
7. Examiner's actions are necessitated by Applicants' amendment, and by Applicants' recently filed IDS. This action, therefore, is final.

Allowable Subject Matter

8. The following are statements of reasons for the indication of allowable subject matter.

9. The relevant prior art is:

   a. Klimasauskas et al., U.S. Patent 5,877,954. ("**Klimasauskas**").

   b. Bhat et al., U.S. Patent 5,477,444. ("**Bhat**").

   c. Lightbody, et al. "Neural Network Modelling of a Polymerisation Reactor". Int'l Conf. on Control, 1994. March 21-24, 1994. Vol.1, pp.237-242. (Hereinafter "**Lightbody**").

   d. Weisstein, Eric W. "Hyperbolic Tangent." From MathWorld. © 1999 CRC Press. http://mathworld.wolfram.com/HyperbolicTangent.html. (Hereinafter "**Weisstein**").

10. **Independent Claims 23-24 are allowed.**

11. The following are the Examiner's reasons for allowance:

   a. Neither Klimasauskas nor Bhat expressly teach the use of "the log of a hyperbolic cosine function".

   b. Lightbody expressly teaches the use of "hyperbolic tangent nodes" in a non-linear neural network used for polymer process control (See Lightbody, p.239, right column, next-to-last paragraph). Examiner interprets that these nodes perform the same purpose as the claimed "transfer function" in the non-linear network model claimed in Claim 16.

However, Lightbody is silent in regards to an integration, summation, or accumulation of the hyperbolic tangent function.

Moreover, Lightbody does not expressly teach the use of "the log of a hyperbolic cosine function" as in the limitations of Claims 6, 16, and 22:

c. Weisstein teaches at the bottom of p.2 that the integral of hyperbolic tangent equals the natural log of hyperbolic cosine, plus some constant. However, since neither Klimasauskas , nor Bhat, nor Lightbody teach an integration, summation, or accumulation of the hyperbolic tangent function, there is no express motivation to combine Weisstein with either Klimasauskas, or Bhat, or Lightbody.

12. None of the cited prior art references, either alone or in combination with one another expressly teach the limitation of "the log of a hyperbolic cosine function" in combination with the other claimed features.

13. Claims 6, 16, and 22 contain allowable subject matter, but stand rejected under 35 USC § 101.

14. In regards to Claims 6, 16, and 22,

a. Neither Klimasauskas nor Bhat expressly teach the use of "the log of a hyperbolic cosine function".

b. Lightbody expressly teaches the use of "hyperbolic tangent nodes" in a non-linear neural network used for polymer process control (See Lightbody, p.239, right column, next-to-last paragraph). Examiner

interprets that these nodes perform the same purpose as the claimed "transfer function" in the non-linear network model claimed in Claim 16. However, Lightbody is silent in regards to an integration, summation, or accumulation of the hyperbolic tangent function.

Moreover, Lightbody does not expressly teach the use of "the log of a hyperbolic cosine function" as in the limitations of Claims 6, 16, and 22:

c. Weisstein teaches at the bottom of p.2 that the integral of hyperbolic tangent equals the natural log of hyperbolic cosine, plus some constant. However, since neither Klimasauskas , nor Bhat, nor Lightbody teach an integration, summation, or accumulation of the hyperbolic tangent function, there is no express motivation to combine Weisstein with either Klimasauskas, or Bhat, or Lightbody.

15. None of the cited prior art references, either alone or in combination with one another expressly teach the limitation of "the log of a hyperbolic cosine function" in combination with the other claimed features.

Claim Rejections - 35 USC § 101

16. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

17. **Claims 1-22 and 25-64 are also rejected under 35 U.S.C. 101 because the claimed invention preempts a 35 U.S.C. 101 judicial exception. The claims**

preempt every "substantial practical application" of an idea – a mathematical algorithm.

18. One may not patent every "substantial practical application" of an idea, law of nature or natural phenomena because such a patent "in practical effect be a patent on the [idea, law of nature or natural phenomena] itself." Gottschalk v. Benson, 409 U.S. 63, 71-72, 175 USPQ 673, 676 (1972).

19. According to MPEP § 2106 (IV)(C)(3), a claim that recites a computer that solely calculates a mathematical formula (see Benson) or a computer disk that solely stores a mathematical formula is not directed to the type of subject matter eligible for patent protection.

20. All of the rejected claims in the instant application share this defect. In particular, none of the rejected independent claims are restricted to any field of application, and therefore the claims are directed to all possible applications of the math recited in the claims.

21. The relevant prior art and contemporaneous art recites a variety of unrelated practical applications for the claimed mathematical results of the claimed modeling of a non-linear process. For example, the instant specification discloses two unrelated applications, polymer process control, and financial control.

22. By Applicants' own admission, "[o]ne of ordinary skill in the art could implement the present computer based method in any number of applications involving modeling a non-linear empirical process, which is in fact, currently believed to be implemented in practice." (See p.30 of the amendment filed 6/11/07).

23. The only commonality between these different uses is the underlying mathematics.

24. Applicant's claims are directed broadly to any practical use of the mathematics in a controller. Examiner therefore has determined that the claims attempt to patent every "substantial practical application" of an idea – a mathematical algorithm. Thus, the claims are non-statutory.

Claim Rejections - 35 USC § 102

25. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

26. The prior art used for these rejections is as follows:

   a. Stephen Piché et al. "Nonlinear Model Predictive Control Using Neural Networks." IEEE Control Systems Magazine. June 2000. pp.53-62. ("**Piché**").

   b. Examiner notes that the instant application claims benefit of U.S. Provisional Application 60/214,875 filed on 06/29/2000. (The next-to-last day in June).

   c. According to MPEP § 2128.02, "A publication disseminated by mail is not prior art until it is received by at least one member of the public. Thus, a magazine or technical journal is effective as of its date of publication (date

when first person receives it) not the date it was mailed or sent to the publisher. In re Schlittler, 234 F.2d 882, 110 USPQ 304 (CCPA 1956).

d. Given the common practice in the publishing industry, Examiner interprets that readers received the cited reference in the month of June, not in the month of July, and therefore the reference qualifies as prior art.

27. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

28. Claims 1-5, 7-15, and 17-21 and 25-64 are rejected under 35 U.S.C. 102(a) as being anticipated by Piché.

29. In regards to Claim 1, Piché teaches the following limitations:

1. A computer-implemented method for modeling a non-linear empirical process, comprising the steps of

creating an initial model generally corresponding to the non-linear empirical process to be modeled, the initial model having a base non-linear function an initial input and an initial output;

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

constructing a non-linear network model based on the initial model, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output, the global behavior being at least in regions of sparse initial input; and

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

calibrating the non-linear network model based on empirical inputs <u>of the non-linear empirical process</u> by using a bound on an analytical derivative of the base non-linear function

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

that allows global properties including at least a global minimum value and a global maximum value of the analytical derivatives to be calculated directly from model coefficients, the global properties used to produce, via a constrained nonlinear optimization method, an analytically constrained model with global behavior, the constrained model enabling precision control of the non-linear empirical process.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

30. In regards to Claim 2, Piché teaches the following limitations:

2. The method of Claim 1, wherein the step of creating the initial model includes specifying a general shape of a gain trajectory for the non-linear empirical process.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

31. In regards to Claim 3, Piché teaches the following limitations:

3. The method of Claim 1, wherein the step of creating the initial model includes specifying a non-linear transfer function suitable for use in approximating the non-linear empirical process.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

32. In regards to Claim 4, Piché teaches the following limitations:

4. The method of Claim 3, wherein the non-linear network includes interconnected transformation elements and the step of constructing the non-linear network includes incorporating the non-linear transfer function into at least one transformation element.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

33. In regards to Claim 5, Piché teaches the following limitations:

5. The method of Claim 4, wherein the step of optimizing the non-linear model includes setting constraints by taking a bounded derivative of the non-linear transfer function.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

34. In regards to Claim 7, Piché teaches the following limitations:

> 7. The method of Claim 1, wherein the non-linear network model is based on a layered network architecture having a feedforward network of nodes with input/output relationships to each other, the feedforward network having transformation elements; each transformation element having a non-linear transfer function, a weighted input coefficient and a weighted output coefficient; and the step of calibrating the non-linear network model includes constraining the global behavior of the non-linear network model to a monotonic transformation based on the initial input by pairing the weighted input and output coefficients for each transformation element in a complementary manner to provide the monotonic transformation.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

35. In regards to Claim 8, Piché teaches the following limitations:

> 8. The method of Claim 1, wherein the step of optimizing the non-linear network model comprises adjusting the optimizing based on information provided by an advisory model that represents another model of the non-linear empirical process that is different from the initial model, the non-linear network model, and the constrained model.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

36. In regards to Claim 9, Piché teaches the following limitations:

> 9. The method of Claim 8, wherein the advisory model is a first principles model of the non-linear empirical process.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

37. In regards to Claim 10, Piché teaches the following limitations:

> 10. A computer-implemented method for modeling a non-linear empirical process, and controlling a greater process, said method comprising the steps of:
>
> creating an initial model generally corresponding to the non-linear

empirical process to be modeled, the initial model having a base non-linear function an initial input and an initial output;

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

constructing a non-linear network model based on the initial model, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output, the global behavior being at least in regions of sparse initial input; and

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

calibrating the non-linear network model based on empirical inputs <u>of the non-linear empirical process</u> by using a bound on an analytical derivative of the base non-linear function

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

that allows global properties including at least a global minimum value and a global maximum value of the analytical derivatives to be calculated directly from model coefficients, the global properties used to produce, via a constrained nonlinear optimization method, an analytically constrained model with global behavior, the constrained model <u>enabling</u> precision control of the non-linear empirical process,

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

the non-linear empirical process <u>being</u> part of <u>the</u> greater process, and deploying the constrained model in a controller that controls the greater process.

(See Piché, especially: "Combining the Nonlinear Steady-State and Linear Dynamic Models" at p.56, last ¶, to p.58, first ¶; "CSTR Application" at p.58, 2nd ¶ to p.60, first ¶; "Polymer Application" at p.60, 2nd ¶ to p.61, last ¶)

38. **Claims 11-15 and 17-20 are rejected based on the same reasoning as claims 1-10. Claims 11-15 and 17-20 are computer apparatus claims that recite limitations equivalent to those recited in method claims 1-10 and taught throughout Piché.**

39. **Claim 21 is rejected based on the same reasoning as claim 1. Claim 21 is a computer program product claim that recites limitations equivalent to those recited in method claim 1 and taught throughout Piché.**
40. **Claim 25 is rejected based on the same reasoning as claim 1. Claim 21 is a method claim that recites limitations equivalent to those recited in method claim 1 and taught throughout Piché.**
41. **New claims 26-64 are rejected based on the same reasoning as claim 1. Claims 26-64 are claims that recite limitations equivalent to those recited in method claim 1 and taught throughout Piché.**

Response to Amendment

42. The new grounds of rejection have been necessitated by Applicants' amendments to the claims, and Applicants' recent IDS.

Claim Rejections - 35 USC § 112

43. The Applicants state (p.30 of the amendment filed 6/11/07) that "One of ordinary skill in the art could implement the present computer based method in any number of applications involving modeling a non-linear empirical process, which is in fact, currently believed to be implemented in practice."
44. Examiner finds this argument to be persuasive regarding the 35 USC § 112, first paragraph rejections. Examiner has withdrawn the 35 USC § 112, first paragraph rejections. Examiner notes that this argument supports Examiner's 35 USC § 101

rejections, because the "present computer-based method" could be "implement[ed] in any number of applications involving a non-linear empirical process."

45. The Applicants state (p.31 of the amendment filed 6/11/07) that "Applicants have amended independent Claims 1, 11, 21, and 25 to recite that the constrained model enables precision control of the non-linear empirical process. Applicants submit that the claims are directed to a computer-implemented method for modeling a non-linear empirical process, and do not omit any essential steps."

46. Examiner finds this argument to be persuasive regarding the 35 USC § 112, second paragraph rejections. Examiner has withdrawn the 35 USC § 112, second paragraph rejections. Examiner notes that this argument supports Examiner's 35 USC § 101 rejections, because the constrained model "enables precision control of the non-linear empirical process", yet does not necessarily do so, because it is directed to "modeling a non-linear empirical process."

Claim Rejections - 35 USC § 101

47. The 35 USC § 101 rejections are maintained for the reasons described in the paragraphs immediately above.

Claim Rejections - 35 USC § 103

48. Applicants' arguments regarding the Klimasauskas and Bhat references are persuasive (see pp.33-39 of the amendment filed 6/11/07). The 35 USC § 103 rejections are therefore withdrawn. New art rejections have been applied.

Conclusion

49. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.

50. U.S. Patent 7,123,971 to Piché. (Piché is a co-author of reference AU2 in the IDS filed 7/23/2007. The patent is too recent to qualify as prior art.)

51. Applicant's amendment and new IDS necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

52. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a biweek, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached at (571) 272-3749.

Any response to this office action should be faxed to (571) 273- 8300, or mailed to:

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or hand carried to:

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Alexandria, VA 22314

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Tech Center 2100 Receptionist, whose telephone number is (571) 272-2100.

Ayal I. Sharon
Art Unit 2123
September 2, 2007

PAUL RODRIGUEZ
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100